

A Review of Maintenance Methods for Electrical Equipment

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Abstract

During the operation of power equipment, it is inevitable that faults will occur. These faults will not only affect the safety of power equipment, but also threaten the lives of workers. So, in order to ensure the normal and stable operation of modern plants, the maintenance of electrical equipment has become a research hotspot in recent years. This paper systematically summarizes the maintenance method of electrical equipment. For the current method, this paper introduces several mainstream maintenance methods, such as infrared temperature measurement method, aerial image recognition method. Finally, the maintenance method is compared with the traditional methods, and the significance and importance of maintenance are described.

Keywords

Electrical equipment maintenance; Infrared temperature measurement; Aerial image recognition.

1. Instruction

In recent years, with the rapid development of science and technology in China, power equipment, as an important energy support, has played an important role. The increasing demand of enterprises for power leads to the increasing variety, complexity and scientific and technological content of electrical equipment. Therefore, optimizing maintenance schemes, such as intelligent maintenance of electrical equipment, has become a research hotspot in recent years.

Since the formation of power system, electric power has become one of the most important energy sources in China. Once it fails, it will cause huge losses to people, enterprises and even the country. Since the 1970s, China has gradually established a perfect power system, trained professional technicians and strengthened the maintenance of electrical equipment. However, accidents caused by improper maintenance occur from time to time. The main reasons are as follows: first, the equipment is updated from time to time, and the improvement of operation complexity makes it difficult for the maintenance level of technicians to meet the requirements of new equipment; Secondly, the maintenance scheme is lack of scientificity and it is difficult to master the appropriate service cycle; In addition, technicians may have careless inspection, misjudgment, omission and other operations in the maintenance process, so that the equipment still has the possibility of failure.

2. Maintenance method of electrical equipment

2.1 Infrared temperature measurement method

Abnormal heating of equipment is a major omen of power equipment failure. In order to prevent overheating failure of electrical equipment, measuring the real-time temperature of equipment to formulate appropriate equipment maintenance scheme is a practical method. Infrared temperature measurement method can better predict the overheating fault of electrical equipment. It mainly judges the temperature of the object to be measured by capturing the infrared emitted by the object whose temperature is much higher than absolute zero. In the screen of infrared temperature measuring equipment, the contour colors displayed by objects with different temperatures are obviously different. The fault can be judged by color difference. In case of abnormal temperature during patrol inspection, the staff shall immediately cut off the power of the equipment, and then analyze it to find the fault location. The main components of infrared temperature measurement system include photodetector, infrared optical system, signal amplifier and signal processor [1].

As early as the 1970s, the Swedish National Electric Power Bureau developed an on-board infrared thermal imager for detecting power equipment, and formulated fault judgment standards and solutions [2]; After that, China also applied the independently developed infrared temperature measurement method to the maintenance of power equipment. In 2008, the national development and Reform Commission issued the application specification of infrared temperature measurement method [3], which promoted the development of infrared temperature measurement method in power system. Since then, infrared temperature measurement has been widely used in power system.

Electrical equipment will also generate thermal radiation during normal operation. Therefore, infrared temperature measurement method needs to distinguish between normal thermal radiation and heat generated in case of failure. In recent years, due to the development of machine learning and other research directions, through learning a large number of data sets, infrared temperature measurement equipment can combine room temperature, humidity and other conditions to be more accurate. Quickly judge whether there is heating fault in electrical equipment.

There are two main types of heating faults of electrical equipment: internal heating and external heating. Because the infrared temperature measurement method is a non-contact temperature measurement method, it has great advantages in solving the problem of internal heating. This method can judge the heat field distribution of an object through the relevant information of the radiation line, and then transmit the signal to the screen of the thermometer to display the temperature inside the object in the way of color change. Through infrared temperature measurement, when the internal components fail, an abnormal color will appear in a specific area of the infrared heat map, and the inspectors can find it at the first time and carry out further maintenance work.

External heating fault is mainly caused by overload caused by large local load, resulting in continuous heat radiation to the surrounding. In case of external heating of the equipment, different from internal heating, it will show a relatively evenly distributed heat field on the infrared heat map. The tester can judge that the equipment is an external heating fault according to this feature, and then determine the fault parts and locations according to the specific distribution of temperature.

2.2 Aerial image recognition method

Due to the wide variety and quantity of electrical equipment in the factory, if the equipment is inspected manually one by one, there will be problems such as low efficiency. Using UAV aerial photography combined with computer vision method to replace manual can not only reduce the workload, but also locate the fault more accurately.

As early as 1940, foreign countries began to study UAV cruise method. Until the beginning of this century, the emergence of computer vision and image processing made UAV aerial photography method have substantive application, and realized automation, practicality and intelligence in the inspection of power equipment. Gsrio method proposed by katrasnik [4] enables UAVs to avoid obstacles independently, and improves endurance and anti shake ability; In recent years, power grid

companies have successively used UAV aerial photography method for patrol inspection instead of manual fault diagnosis in high-risk environment. At present, the efficiency of UAV cruise method has far exceeded that of manual [5]. From the current research situation, computer vision and image processing method is a key method of UAV cruise.

In aerial image recognition method, the main feature extraction is color, texture, shape and spatial relationship. For electrical equipment, some faults come from foreign matters on the equipment and transmission line, resulting in a significant reduction in the limit discharge distance and great risk. In humid environment, transmission line short circuit fault may occur, resulting in circuit breaker tripping, user power failure, equipment damage and other serious hazards. For the problem of foreign object recognition, Wang Haiyang [6] defined the specific frame with fault in the aerial video as the key frame, and extracted the key information by extracting the key frame, that is, whether there is a foreign object hanging; Chen Rui [7] proposed a foreign object hanging identification method of transmission line based on line detection and segmentation algorithm and multi feature constraints, and a fault identification algorithm based on Harris corner detection and morphological processing. The photos are processed by line screening, feature constraint segmentation, etc., and then the fault frame is extracted through contour search to determine the fault location.

3. Summary

Electrical equipment not only maintains the normal operation of an enterprise, but also affects the life and property safety of staff. [8] A little carelessness will cause accidents. Therefore, the primary consideration of relevant enterprises in terms of safety is the stable operation of electrical equipment. Regular maintenance can prevent faults to a certain extent, but the traditional manual inspection method can not carry out targeted inspection of faults, which not only causes a waste of human resources, but also will be affected by the subjectivity of staff; Today's mainstream infrared temperature measurement method, aerial image recognition method and multi-path detection method not only improve the detection efficiency and accuracy, but also replace the manual detection of equipment in high-risk environment, and ensure the safety of personnel to a certain extent.

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